

Enhanced Water Quality Monitoring and Modeling Program for the A.R.M. Loxahatchee National Wildlife Refuge Quarterly Update Report – July 2009

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Overview

This update is a summary of activities since the previous status report of April 2009 on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. A project overview, and other detailed information about the program can be found at: http://sofia.usgs.gov/lox_monitor_model/. The primary objective of this overall program (Brandt et al. 2004) focuses on providing information for use in ecological management of the Refuge (e.g., USFWS 2007a, b).

The Refuge's monitoring component of this program also addresses one of the Consent Decree Principals recommendations (17 December 2003):

B. Enhancing Monitoring of the Refuge

Design and implement an enhanced monitoring program to improve spatial and temporal understanding of factors related to phosphorus dynamics.

The Refuge's modeling component of this program also addresses several of the Consent Decree Principals recommendations (17 December 2003):

C. Modeling of the Refuge

- 1. Develop a water quality/hydraulic model for the Refuge with a phosphorus cycling component.*
- 2. Evaluate issues associated with phosphorus loads and transports within the L-40 and L-7 canals.*
- 3. Develop and track a simple phosphorus mass-balance model for the Refuge.*

Information Availability

Through collaboration with USGS, information from the Refuge's Enhanced Water Quality Monitoring and Modeling Program has been made available on the USGS' SOFIA web site at: http://sofia.usgs.gov/lox_monitor_model/.

Final data for monthly samples through May 2006 are publicly posted on DBHYDRO by the SFWMD at <http://www.sfwmd.gov/org/ema/dbhydro/index.html>. Data for June 2006-March 2009 are posted on the Technical Oversight Committee's web site at https://my.sfwmd.gov/portal/page?_pageid=2235,4688652,2235_4688399&_dad=portal&_schema=PORTAL. This report includes information from samples collected through June 2009.

Water Quality Data Analyses Update

Primary efforts for this quarter involved exploring mechanisms to continue translating information from the program to aid in Refuge management decisions, and efforts to finalize the 4th Annual Report.

Monitoring Update (April 2009 – June 2009)

Sampling of the enhanced water quality monitoring network (**Figure 1**) occurred at 6 stations in April 2009, 5 stations in May 2009, and 37 stations in June 2009 (**Table 1**).

Total phosphorus data available to date for July 2008 to June 2009 are presented in **Table 1**. Maps of stations where samples were collected for April 2009 through June 2009 are presented in **Figures 2-4**.

Conductivity sonde deployment information for July 2008 to June 2009 is presented in **Table 2**.

Modeling Update

During the second quarter of 2009, the Refuge modeling team continued efforts to finalize model versions. A meeting of the Independent Technical Advisory Panel was held on May 11, 2009, at the A.R.M Loxahatchee NWR Visitor Center auditorium. This modeling workshop included participation of the public and other governmental agencies as well as the technical review panel. Following the meeting, a matrix of comments and suggestions from the panel and others was compiled. Efforts are ongoing to address those comments. Efforts also continued on documentation of model development, use, and appropriate application. Finally, a short document providing an overview of the status of Refuge modeling was released in June, and is available at:

http://my.sfwmd.gov/portal/page/portal/pg_grp_sfwmd_era/portlet_archives_meetings_s ubtabs/tab23692216/refuge_model_update_june2009.pdf

Next Steps

The next steps for this program include completion of the 4th Annual Report, and additional model development and application.

References

- Brandt, L.A., Harwell, M., Waldon, M. (2004) Work Plan: Water Quality Monitoring and Modeling for the A.R.M. Loxahatchee National Wildlife Refuge: 2004-2006. Prepared for the A.R.M. Loxahatchee National Wildlife Refuge. April, 2004. 33 pp.
- USFWS. (2007a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Monitoring and Modeling Program – 2nd Annual Report – February 2007. LOXA06-008, U.S. Fish and Wildlife Service, Boynton Beach, FL. 183 pp.
- USFWS. (2007b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 3rd Annual Report – October 2007. LOXA07-005, U.S. Fish and Wildlife Service, Boynton Beach, FL. 116 pp.

Table 1. Total phosphorus data (ppb) available for July 2008 – June 2009 from the Enhanced Water Quality Monitoring Program for: (a) marsh, and (b) canal stations for the A.R.M. Loxahatchee National Wildlife Refuge. Graphical representation of station locations are shown in Figure 1.

a) Marsh stations

Marsh Station	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09
LOXA101	7	8	11	14	3	10	9	3	-	-	-	32
LOXA102	U	7	7	15	3	28	10	-	-	-	-	9
LOXA103	U	11	8	16	3	15	11	-	-	-	-	10
LOXA105	3	18	14	17	11	10	9	3	-	-	-	28
LOXA106	U	12	8	14	7	10	-	-	-	-	-	21
LOXA107	-	7	6	10	7	4	-	-	-	-	-	13
LOXA108	U	6	5	9	3	13	-	-	-	-	-	5
LOXA109	U	8	11	13	7	7	9	3	-	-	-	12
LOXA110	-	6	7	10	7	3	3	-	-	-	-	3
LOXA111	U	3	9	10	3	6	6	-	-	-	-	4
LOXA112	U	8	21	12	7	8	8	3	-	-	-	12
LOXA113	U	4	4	7	7	5	3	-	-	-	-	5
LOXA114	U	5	7	10	3	7	5	3	-	-	-	5
LOXA116	X	X	X	X	X	X	X	X	X	X	X	X
LOXA117	11	12	18	24	9	10	8	3	-	-	-	31
LOXA118	4	8	10	15	8	10	9	3	U	-	-	7
LOXA119	4	3	7	10	3	6	9	3	4	-	-	8
LOXA120	4	3	5	6	3	3	30	3	3	9	-	2
LOXA122	U	12	15	15	6	7	62	3	-	-	-	22
LOXA124	U	7	20	18	3	5	4	3	13	-	-	37
LOXA126	7	3	6	11	3	4	12	3	-	-	-	15
LOXA127	5	3	5	11	3	3	-	-	-	-	-	10
LOXA128	5	3	8	7	3	3	3	-	-	-	-	2
LOXA130	9	10	7	16	10	13	7	3	-	-	-	17
LOXA131	21	5	3	7	3	8	7	3	-	-	-	5
LOXA133	-	38	19	31	18	21	-	-	-	-	-	140
LOXA134	10	9	10	15	8	12	11	3	-	-	-	29
LOXA136	26	16	21	64	9	14	9	3	-	-	-	51
LOXA137	U	10	14	17	3	10	16	3	-	-	-	27
LOXA138	U	8	15	9	3	5	17	-	-	-	-	7
LOXA139	U	7	14	12	3	11	-	-	-	-	-	14
LOXA140	U	10	3	10	3	12	9	-	-	-	-	20
LOXA141	8	4	13	12	6	6	8	3	U	-	-	12
MAX	26	38	21	64	18	28	62	3	13	9	0	140
MIN	3	3	3	6	3	3	3	3	3	9	0	2

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

X indicates station no longer sampled.

Table 1 cont.

b) Canal stations

Canal Station	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09
LOXA104	32	36	36	33	34	26	22	10	32	30	30	60
LOXA115	31	46	36	33	23	12	20	4	25	19	11	26
LOXA129	23	52	34	42	21	19	11	21	40	44	34	130
LOXA132	20	56	35	48	24	22	12	24	37	37	58	130
LOXA135	13	65	54	49	13	22	14	21	42	33	45	130
MAX	32	65	54	49	34	26	22	24	42	44	58	130
MIN	13	36	34	33	13	12	11	4	25	19	11	26

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 2. July 2008 – June 2009 conductivity sonde deployment information, separated by transect, for the A.R.M. Loxahatchee National Wildlife Refuge. X = data collected from sonde deployment during that month. Graphical representation of station locations are shown in Figure 1.

Site ID	2008						2009					
	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
LOXA 104	X	X	X	X	X	X	X	X	X	X	X	X
LOXA 105	X		X		X		X		X		X	
LOXA 106	X		X		X		X		X		X	
LOXA 107	X		X		X		X		X		X	
LOXA 108	X		X		X		X		X		X	
LOXA 111		X		X		X		X		X		X
LOXA 112		X		X		X		X		X		X
LOXA 113		X		X		X		X		X		X
LOXA 114		X		X		X		X		X		X
LOXA 115	X	X	X	X	X	X	X	X	X	X	X	X
LOXA 116					X	X		X	X		X	
LOXA 117					X	X		X	X		X	
LOXA 118					X	X		X	X		X	
LOXA 119					X	X		X	X		X	
LOXA 120					X	X		X	X		X	
LOXA 126		X		X		X		X		X		X
LOXA 127		X		X		X		X		X		X
LOXA 128		X		X		X		X		X		X
LOXA 129	X	X	X	X	X	X	X	X	X	X	X	X
LOXA 130	X		X		X		X		X		X	
LOXA 131	X		X		X		X		X		X	
LOXA 132	X	X	X	X	X	X	X	X	X	X	X	X
LOXA 133	X		X		X		X		X		X	
LOXA 135	X	X	X	X	X	X	X	X	X	X	X	X
LOXA 136	X		X		X		X		X		X	
LOXA 137	X		X		X		X		X		X	
LOXA 138	X		X		X		X		X		X	
LOXA 139	X		X		X		X		X		X	
LOXA 141					X							
LOXA 142	X					X	X	X	X		X	
LOXA 143		X		X		X		X		X		X
LOXA 144		X		X		X		X		X		X
LOXA 145		X		X		X		X		X		X
LOXA 146		X		X		X		X		X		X
LOXA 147	X				X	X	X	X	X	X		X
LOXA 148		X		X		X		X		X		X
LOXA 149		X		X		X		X		X		X
LOXA 150		X		X		X		X		X		X
LOXA 151	X	X	X	X		X	X	X	X	X	X	X
LOXA 152	X	X	X		X	X	X	X	X	X	X	X
LOXA 153	X	X	X	X		X	X	X	X	X	X	X
I-BC	X		X	X	X		X	X		X	X	X
LOX04	X		X		X		X		X		X	
LOX06		X		X		X		X		X		X
LOX07		X		X		X		X		X		X
LOX08		X		X		X		X		X		X
LOX09		X		X		X		X		X		X
LOX10		X		X		X		X		X		X
LOX15		X		X		X		X		X		X

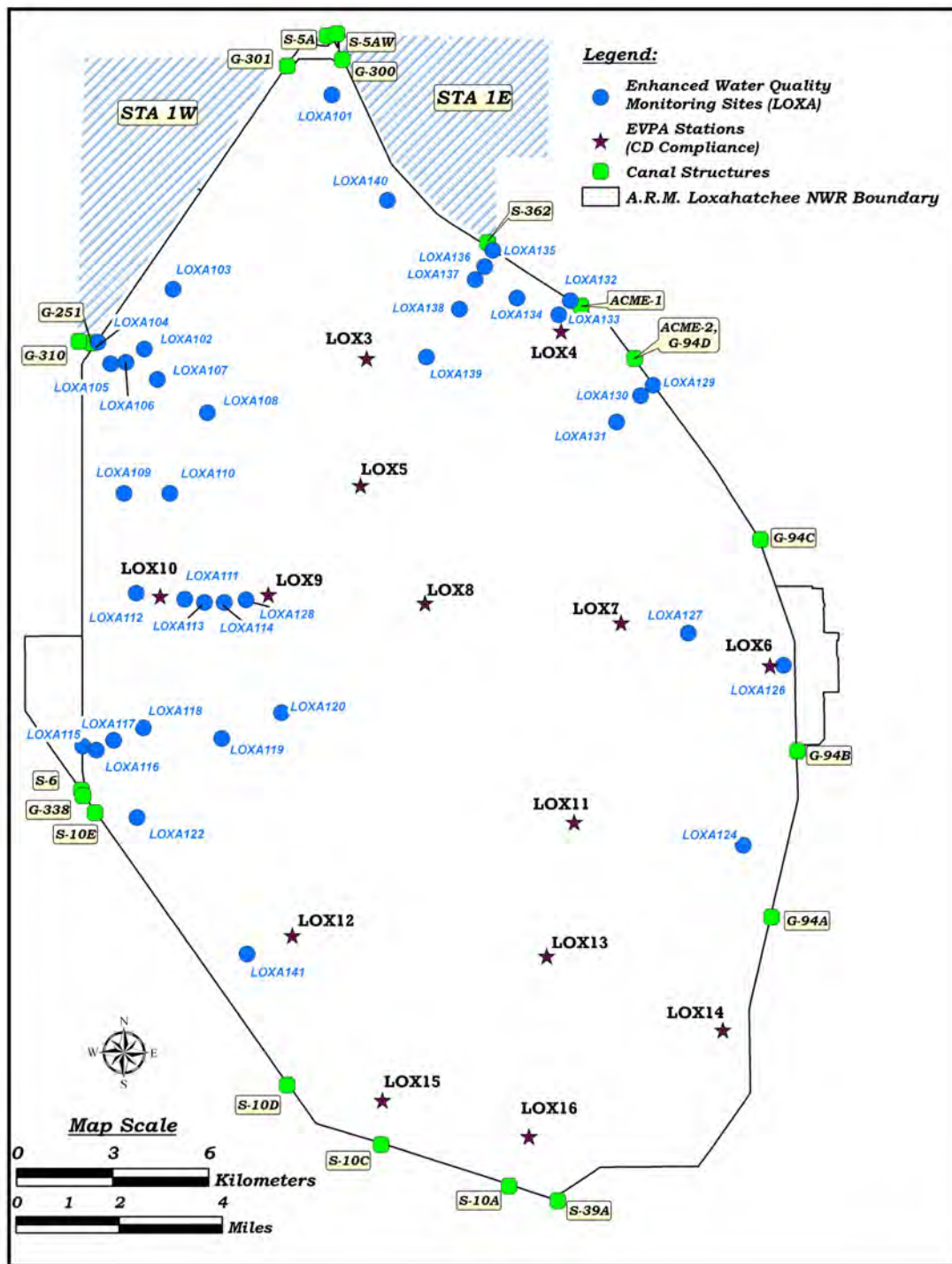


Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

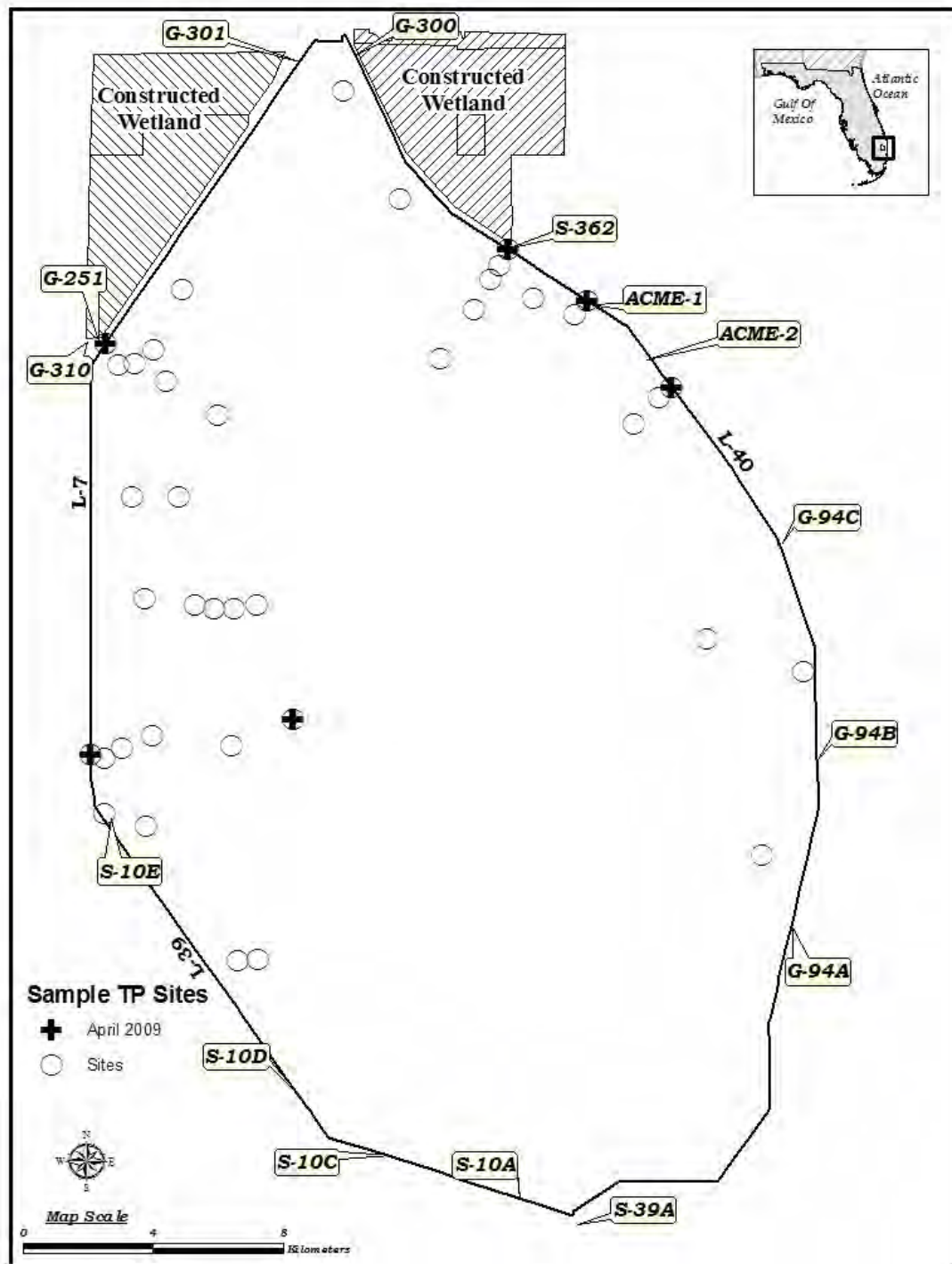


Figure 2. April 2009 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

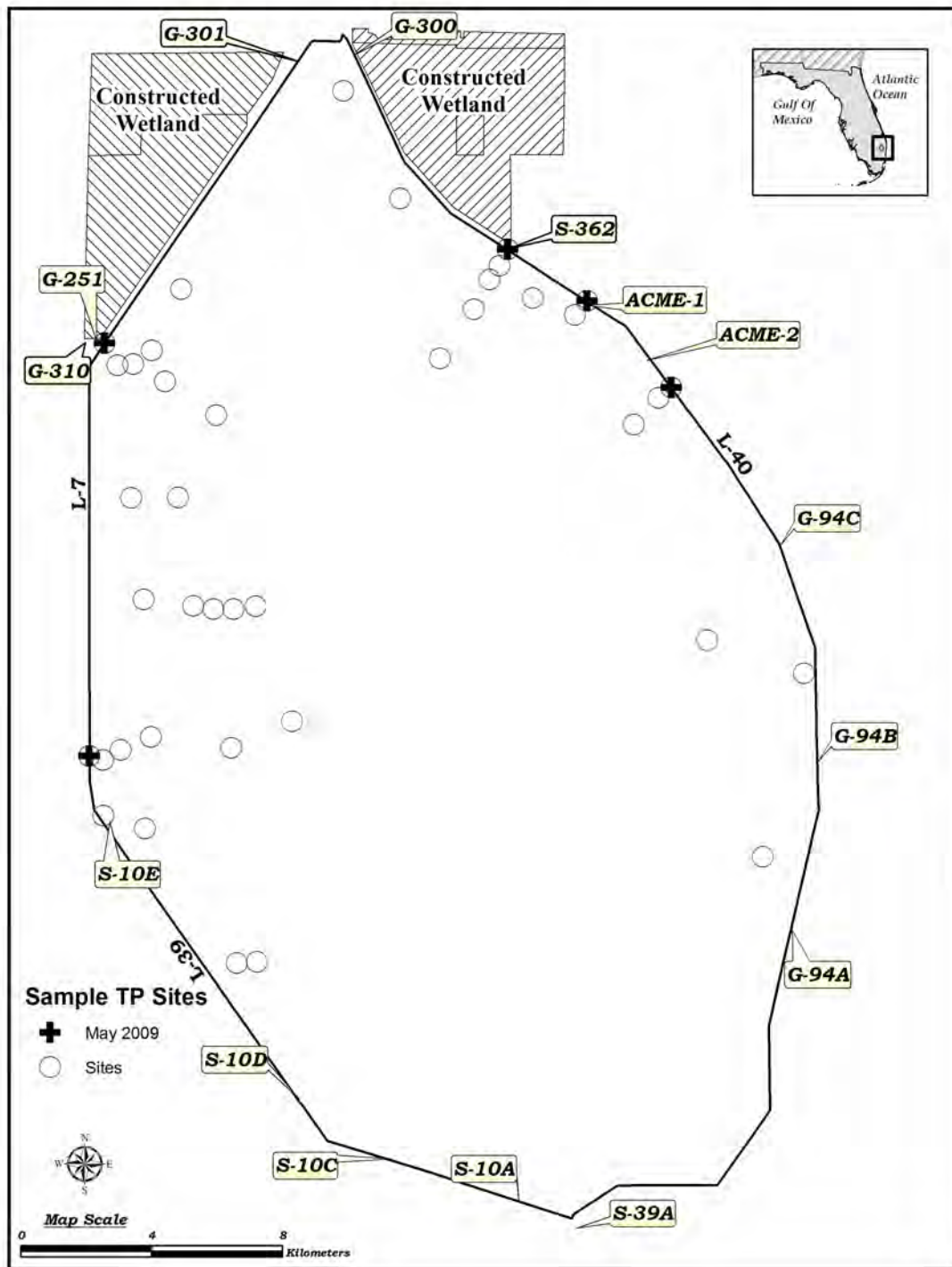


Figure 3. May 2009 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

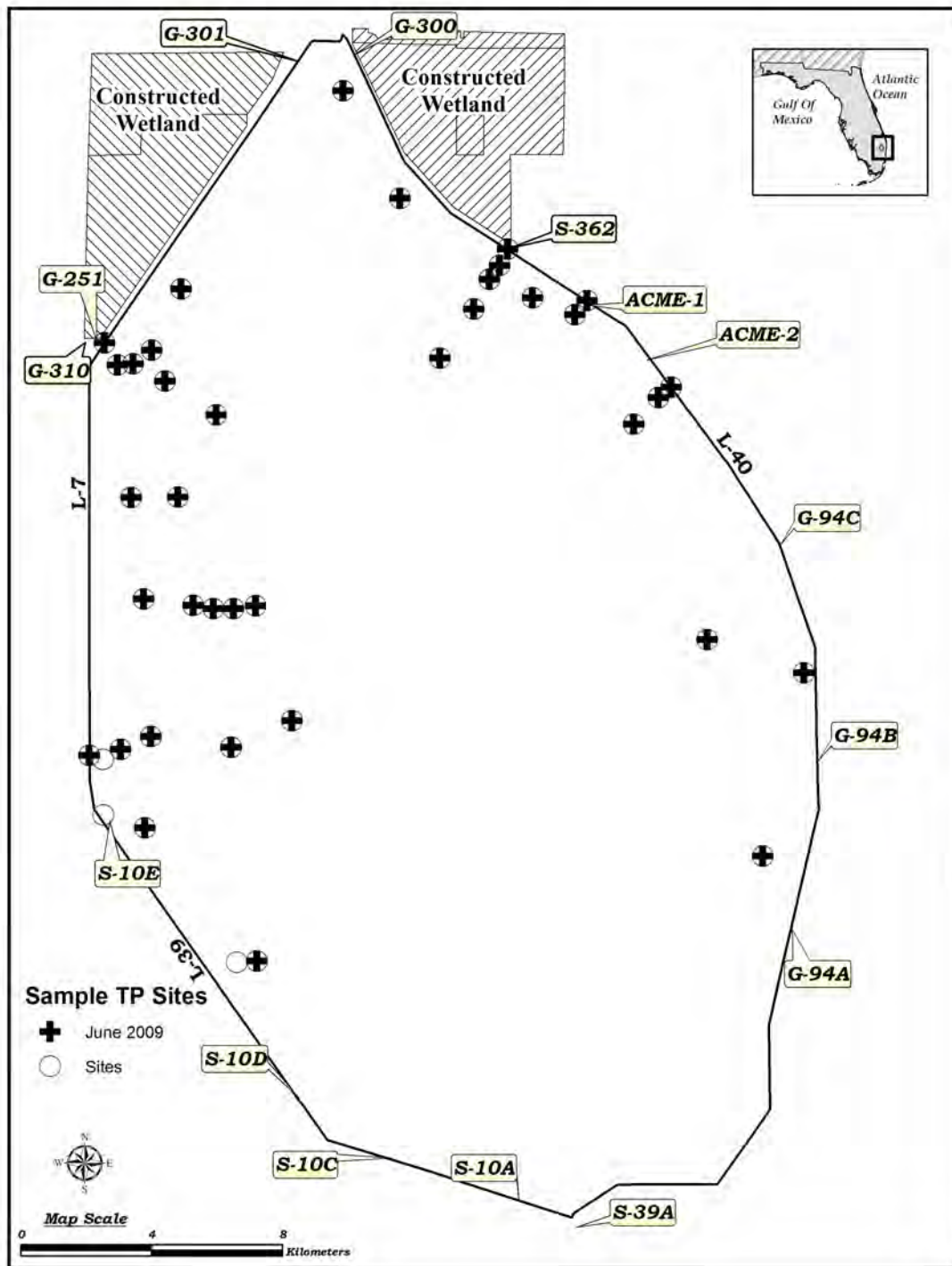


Figure 4. June 2009 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.